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REPORT ON FORCED EMERGENCE
OF OVERWINTERING SPRUCE BUDWORM LARVAE
FOR THE PROPOSED 1962 STATE OF WASHINGTON CONTROL PROJECT

By

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INTRODUCTION

Since 1959 an epidemic outbreak of the spruce budworm, Choristoneura fumiferana (Clem.), has been in progress in southern Washington. The infestation is located on portions of the Yakima Indian Reservation and the Glenwood District of the State of Washington.

The regional cooperative forest insect survey has mapped the infestation annually and the results are shown below:^{1/}

<u>Area</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>
Yakima Indian Reservation	4,800	6,720	7,200
Glenwood District	<u>5,160</u>	<u>14,240</u>	<u>22,400</u>
Total	9,960	20,960	29,600

Budworm population levels have been estimated and trends predicted for the past three years by sampling the egg stage.^{2/} The increase in population reported in 1961 and the predicted upward trend for 1962 indicates timber values will be endangered through top killing and growth lost from repeated defoliation. As a result of these findings and the increasing size of the infestation, control of the spruce budworm by aerial spraying in 1962 was recommended by the Northwest Forest Pest Action Council at the October 27, 1961 meeting.

Scheduled for treatment are 47,500 acres, consisting of 29,600 acres of epidemic infestation and 17,900 acres of lightly infested timber and buffer zones.

A final check before beginning control is the spring study to determine survival of the overwintering spruce budworm larvae. This study consists of sampling trees which contain hibernating larvae within the proposed control area and forcing early emergence in the laboratory. The results of this study for the 1962 project are presented in this report.

OBJECTIVES

The primary purpose of this study is to determine whether survival from the overwintering larval population is sufficient to justify control by spraying. The results of an earlier study of an infestation in eastern Oregon will be used as a standard for comparison.^{3/}

^{1/} Buckhorn, W. J., and Orr, P. W., Forest Insect Conditions in the Pacific Northwest during 1960. (Multilithed.) September 1961.

^{2/} Buffam, P. E., Evaluation of 1961-62 Spruce Budworm Populations in Oregon and Washington. U. S. Forest Service, Region Six. (Processed.) October 24, 1961.

^{3/} Buckhorn, W. J., Orr, P. W., and Williams, C. B., Jr., Report on Forced Emergence of Overwintering Spruce Budworm Larvae on Units Within the Proposed 1958 Oregon Control Project. (Processed.) May 1958.

A secondary objective is to determine the distribution of hibernating larvae along the bole of the tree. Limb samples have usually given more reliable estimates of larval populations than bole samples. Sampling the bole at various heights on a tree may, however, provide an alternate sampling location which is comparable to limb sampling.

METHODS

Collection procedures were similar to those used in past studies. Collection points were selected in advance, representing all intensities of defoliation within the infestation. The rating of defoliation was the same as on aerial surveys:

Light - Slight feeding.

Moderate - Top one-fourth of tree defoliated.

Heavy - One-half of tree defoliated, top killing in progress.

Very heavy - Three-fourths of tree defoliated, severe, some tree killing in progress.

Sampling was done on April 2, 3, and 4. Collectors drove to some areas and used a sno-cat to reach collection points at higher elevations. At each point five trees from eight to 16 inches d.b.h. showing feeding typical of that area were chosen. The trees were felled and 15 limb sections approximately 15 inches long were cut from each tree at mid-crown. Bole samples were also taken from one of these five trees. Bole sections 15 inches long were cut from internodes at ten foot intervals from stump height to 40 feet. Each bole was then split lengthwise, providing five bole half-sections per collection point.

The collections were labeled by collection point, tree number (and height of sample for boles), tree species, diameter, and degree of budworm defoliation. Seven collection points were sampled, totaling 35 trees. Twenty samples were from Douglas-fir and 15 were from white fir.

The samples were taken to the Forest Service Sellwood Laboratory in Portland for rearing. Limb samples were trimmed to 15 inches, and the larger bole half-sections split into quarters. All of the foliage was removed from both limb and bark samples to prevent the emerging larvae from attacking the needles. Collections were placed in 5-gallon ice cream containers and sealed with tape. Glass vials inserted into each container lid allowed for collection of the emerging larvae. Larval emergence began on April 8 and larvae were collected and counted daily until emergence ceased on April 16. On April 17 the containers were opened and larvae remaining inside each container were counted.

RESULTS

The detailed findings of this study are presented in tables 1 through 4 in the appendix. The number of larvae obtained from limb samples indicate sufficient population survival to justify control by spraying (table 1). The average number of larvae per 100 square inches of bark area on limb sections was nearly three times the number obtained from a similar study in 1958. Some

difference was expected; however, since trees sampled for this year's study generally showed greater defoliation on some areas.

Some difference was noted between emergence from limb samples of white fir and Douglas-fir (table 2). Douglas-fir samples showed consistently higher emergence than did white fir samples. This occurred even though most of the white fir samples were taken from heavily defoliated trees, while those of Douglas-fir were mainly from trees with light and moderate defoliation.

Larval emergence from bole half-sections generally increased with height in the tree (table 3). Sections from the 30- and 40-foot levels consistently showed greater emergence than sections from lower levels. Comparison of emergence between individual bole samples and limb samples, on an area basis, showed limbs produced more larvae per 100 square inches of bark than did boles (table 4). On a tree basis, 15 limb sections produced more larvae in every instance than did five bole half-sections. At no given height along the tree did emergence from boles appear to be comparable to emergence from limbs.

CONCLUSIONS

The population survival indicated by this study justifies the need for control of the spruce budworm this summer.

Emergence from bole samples tended to increase with increasing height in the tree. On a bark area basis, bole half-sections taken at intervals along the tree produced fewer larvae than did limb sections. Since limb samples also produced greater numbers of larvae on a tree basis than did bole samples, this study indicated that limbs gave a more reliable estimate of the maximum hibernating population.

A P P E N D I X

Table 1.--Density of hibernating larvae on limbs of trees at seven collecting points near Goldendale, Washington

Collection point <u>1/</u>	Rating of defoliation	Trees sampled	Total larval emergence	Bark area sampled	Larval emergence per 100 sq. inch of bark area
		-- <u>Number</u> --		<u>Sq. inch</u>	<u>Number</u>
2	Heavy	5	1,056	3,411	31.0
3	Moderate to heavy	5	959	4,066	23.6
4	Light	5	103	3,345	3.1
6	Moderate to heavy	5	669	3,657	18.3
7	Moderate	5	741	3,364	22.0
8	Moderate	5	489	4,019	12.2
9	Moderate to heavy	5	452	3,255	13.9
All collection points		35	4,469	25,117	
Weighted average					17.8

1/ Collection points 1, 5, and 10 were not sampled.

Table 2.--Larval emergence on limbs by location and tree species

Collection point	Douglas-fir			White fir		
	Trees sampled	Larval emergence		Trees sampled	Larval emergence	
		Total	Per tree		Total	Per tree
----- <u>Number</u> -----						
2	1	622	622	4	434	108
3	1	202	202	4	757	189
4	5	103	21	0	0	0
6	4	621	155	1	48	48
7	4	641	160	1	100	100
8	2	244	122	3	245	82
9	3	295	98	2	157	78
Total	20	2,728		15	1,741	
Weighted average			136.4	116.1		

Table 3.--Distribution of hibernating larvae along the bole of trees at seven collecting points near Goldendale, Washington

Sample height	Total larval emergence							All trees
	Collection point							
	2	3	4	6	7	8	9	
	-----Number-----							
Stump	0	1	0	0	2	0	0	3
10'	0	0	0	1	0	3	1	5
20'	0	2	1	10	2	1	14	30
30'	16	5	0	12	6	6	25	70
40'	17	35	--	9	4	0	9	74
Total	33	43	1	32	14	10	49	182

Table 4.--Density of hibernating larvae on limbs and boles of trees at seven collecting points near Goldendale, Washington

Collection point	Tree number	Source of sample	Total larval emergence	Bark area sampled	Larval emergence per 100 sq. inch of bark area
			<u>Number</u>	<u>Sq. inch</u>	<u>Number</u>
2	1	Limbs	105	692	15.2
		Boles			
		1'	0	231	0
		10'	0	198	0
		20'	0	159	0
		30'	16	181	8.8
		40'	17	130	13.1
3	5	Limbs	202	598	33.7
		Boles			
		1'	1	238	0.4
		10'	0	181	0
		20'	2	198	1.0
		30'	5	157	3.2
		40'	35	145	24.1
4	5	Limbs	19	697	2.7
		Boles			
		1'	0	220	0
		10'	0	168	0
		20'	1	163	0.6
		30'	0	148	0
6	3	Limbs	391	834	46.8
		Boles			
		1'	0	252	0
		10'	1	214	0.5
		20'	10	192	5.2
		30'	12	130	9.2
		40'	9	130	6.9
7	3	Limbs	100	660	15.1
		Boles			
		1'	2	232	0.9
		10'	0	198	0
		20'	2	219	0.9
		30'	6	211	2.8
		40'	4	178	2.2

Continued on page 7.

Table 4.--Density of hibernating larvae on limbs and boles of trees at seven collecting points near Goldendale, Washington ... (Continued)

Collection point	Tree number	Source of sample	Total larval emergence	Bark area sampled	Larval emergence per 100 sq. inch of bark area
			<u>Number</u>	<u>Sq. inch</u>	<u>Number</u>
8	5	Limbs	56	763	7.3
		Boles			
		1'	0	253	0
		10'	3	237	1.3
		20'	1	199	0.5
		30'	6	171	3.5
		40'	0	148	0
9	1	Limbs	114	570	20.0
		Boles			
		1'	0	204	0
		10'	1	207	0.5
		20'	14	186	7.5
		30'	25	162	15.4
		40'	9	136	6.6

1. The first part of the document is a list of the names of the persons who have been appointed to the various offices of the corporation.

Name of Officer	Office	Term	Residence
John A. Smith	President	1898-1900	New York City
James B. Jones	Vice President	1898-1900	New York City
William C. Brown	Secretary	1898-1900	New York City
Robert D. White	Treasurer	1898-1900	New York City
Charles E. Green	Director	1898-1900	New York City